

RESEARCH ARTICLE

Bruggmannia chapadensis sp. nov. (Diptera: Cecidomyiidae), a new midge inducing galls on *Guapira pernambucensis* (Nyctaginaceae) from the Parque Nacional da Chapada dos Guimarães, Mato Grosso State, Brazil

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ABSTRACT. *Bruggmannia chapadensis* sp. nov. is described and illustrated based on characters of the larva, pupa and adults of both sexes, from specimens collected in Cerrado areas of Parque Nacional da Chapada dos Guimarães, state of Mato Grosso, Brazil. The new species is characterized by tarsal claws bent at distal 1/3; well-developed empodia, not reaching the bend in claws; cerci rounded; hipoproct shorter than cerci; aedeagus with globose apex; gonostylus semicircular; ovipositor protrusible about 1.4 times longer than sternite 7; pupal antennal bases enlarged, conical, upper facial horns semicircular; prothoracic spiracle short, abdominal segments 2–8 with one row of dorsal spines; larval terminal segment elongate, with four setose terminal papillae. This new species was collected from lenticular leaf galls of *Guapira pernambucensis* (Casar.) Lundell (Nyctaginaceae). This is the first record of *Bruggmannia* galls on this plant species. In Brazil, 13 species of *Bruggmannia* were previously known, none recorded from Mato Grosso.

KEY WORDS. Cerrado, gall midge, insect-plant interaction, taxonomy.

INTRODUCTION

Bruggmannia Tavares, 1906 is a Neotropical genus characterized by the following characters (Gagné 1994): male flagellomeres constricted near middle of nodes, flagellomere necks longer and circumfila less appressed to flagellomeres than in other genera of Schizomyiina (Asphondyliini), palpus three-segmented; empodia much shorter than claws; ovipositor short, not pigmented, with elongate ventral and sparse dorsal setae, cerci separate and tiny. The immature stages also have some easily recognizable characters such as base of pupal antenna weakly developed or not produced, and larvae without prothoracic spatula (Gagné 1994).

There are 19 described species of *Bruggmannia*, 13 from Brazil, all gall inducers. Among them, 16 are associated with Nyctaginaceae, and the other three species are associated either with Rubiaceae (two spp.) or Myrsinaceae (one sp.) (Gagné and Jaschhof 2014). *Guapira* Aubl., *Neea* Ruiz. and Pav. and *Pisonia* L. are the plant genera that serve as hosts for most species of *Bruggmannia*, four, eight and four, respectively. Undetermined

species of *Bruggmannia* (probably new) have been recorded on *G. opposita* (Vell.) Reitz, *G. nitida* (Mart. ex Schmidt) Lundell, *G. pernambucensis* (Casar.) Lundell (Maia et al. 2008, 2014, Bregonci et al. 2010, Rodrigues et al. 2014), *Neea* sp. (Maia 2014), *Eugenia copacabanensis* Kiaersk (Carvalho-Fernandes et al. 2016) and *Lauraceae* sp. (Maia et al. 2014).

The new species described here was found inducing galls (Fig. 1) on *G. pernambucensis*. *Guapira* is a Neotropical genus with about 70 species distributed from the southern United States to northern Argentina. In Brazil, this genus can be found in the following phytogeographic domains: Amazon Forest, Caatinga (dry forest), Cerrado and Atlantic Forest. *Guapira pernambucensis* is a shrub endemic to Brazil where it occurs in the northeast and southeast areas of Brazil in the Atlantic Forest. This species is commonly known as “mangue-branco” and “João mole” (Flora do Brasil 2017).

The objective of this study was to describe a new species of *Bruggmannia* associated with *G. pernambucensis*, contributing to the knowledge of its diversity in the Neotropics.

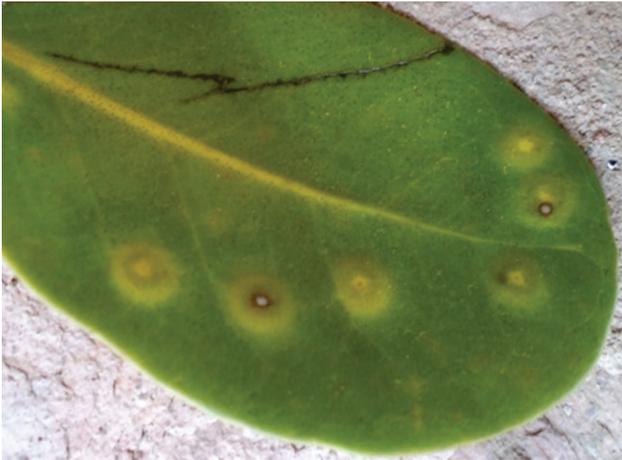


Figure 1. *Bruggmannia chapadensis* sp. nov.: leaf gall, lenticular, glabrous and one-chambered on leaves of *Guapira pernambucensis* (Casar.) Lundell (Nyctaginaceae).

MATERIAL AND METHODS

This study is part of the project “Diptera dos estados do Mato Grosso, Mato Grosso do Sul e Rondônia: diversidade, sistemática e limites distribucionais”. The aim of this project is to inventory the diversity of Diptera from Brazil’s North and Midwest areas.

The species described in the present study was collected in September 2011 at Parque Nacional da Chapada dos Guimarães (National Park of Chapada dos Guimarães) in Mato Grosso (Brazil), on *Guapira pernambucensis*. The gall was photographed using a digital camera and characterized according to its shape, color, presence or absent of trichomes, and also the number of internal chambers. The collected material was labeled and transported to the Laboratório de Diptera (Museu Nacional/UFRJ, Rio de Janeiro). Samples of the gall were placed in plastic pots at room temperature to rear adults. Other samples were dissected to collect immature stages of the inducer. The specimens were prepared and mounted on slides following the methods outlined in Gagné (1994).

The gall midge genus was identified using Gagné’s (1994) key to Neotropical genera and the species were determined as new after comparison with the original descriptions and illustrations of the known species, and comparison with specimens from the Diptera collection of the Museu Nacional (MNRJ). The diagnostic characters were illustrated with the help of an optical microscope. Photographs were taken by a Nikon Eclipse e200 camera coupled to an optical microscope. All drawings were scanned and processed in Adobe Illustrator CC 2015 and both plates and photographs were processed in Photoshop CS6. The gall midge specimens, including the types, are deposited in the MNRJ. The field work was done by Maia, V.C. and Ascendino, S., and the description of the new species by Proença, B. and Maia, V.C.

The host plant was identified by Dr. Gracialda Ferreira and Manuel Cordeiro (Universidade Federal Rural da Amazônia), and the exsiccate was deposited in the herbarium of that institution.

TAXONOMY

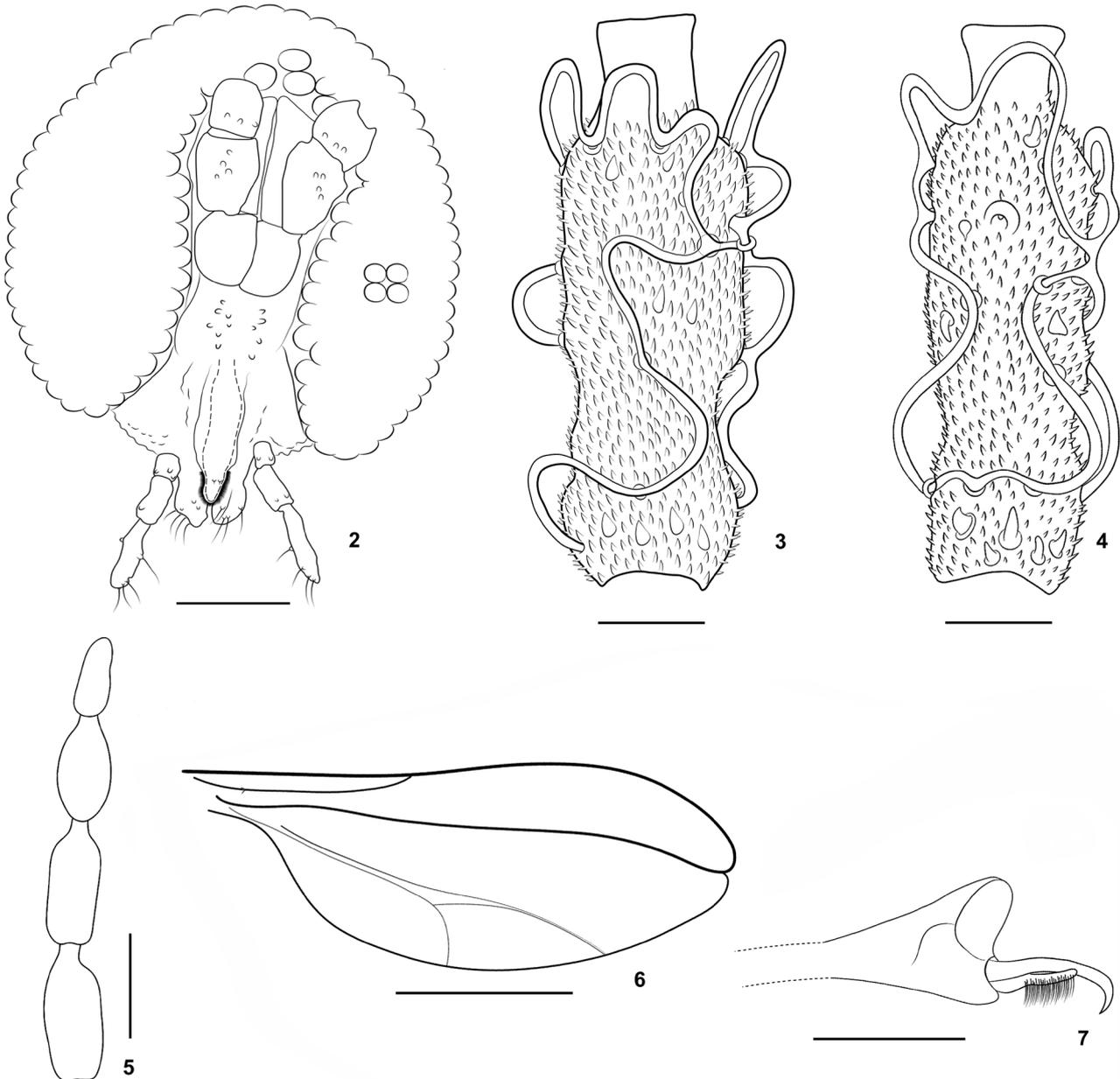
Cecidomyiidae
Asphondyliini
Schizomyiina

Bruggmannia chapadensis sp. nov.

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Diagnosis. Adult: Palpus three segmented, first and second segments cylindrical, third claviform; flagellomeres cylindrical and slightly constrict near the base. Tarsal claws bend at distal 1/3; empodia well developed, setose, not reaching the bend in claws. Male terminalia: cerci rounded; hipoproct shorter than cerci; aedeagus with globose apex; gonostylus semicircular. Ovipositor protrusible about, 1.4 times longer than sternite 7, tapering to the apex. Pupa: antennal bases enlarged, conical, pointed apically and six times shorter than the basal antennal width; upper facial horns semicircular; prothoracic spiracle short 1.5 times longer than the antennal width; abdominal segments 2–8 with one row of dorsal spines near to the anterior portion of the segment. Larva: terminal segment elongate, with 0.30 mm length and four terminal papillae with seta.

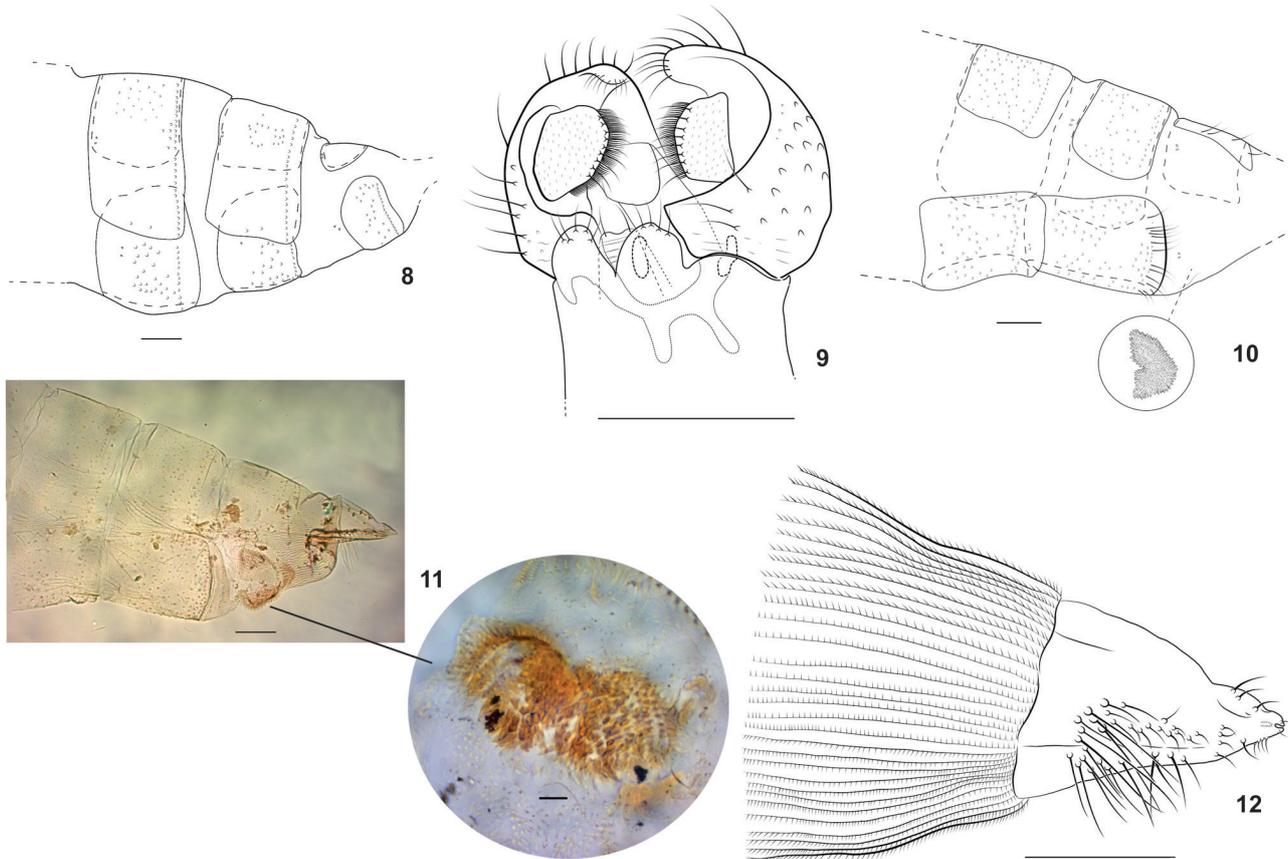
Description. Adult. Body length: 1.8 mm in male (n = 1) and 3.2–3.3 mm in female (n = 3). Head (Fig. 2): Frontoclypeus with 5–8 setae (n = 4); labrum long-attenuate with two setae (n = 4); hypopharynx longer than labrum and apically setulose; labellae with a sharp apex and four pairs of setae (n = 3); palpus with three setose crescent segments: segment one cylindrical, shorter than the other two, the second cylindrical and the third claviform, longer than the previous. Eye facets circular, closely approximated. Antenna with scape cylindrical, with scales and two pairs of setae each (n = 3), pedicel spheroid with scales and three pairs of setae each; male and female flagellomeres cylindrical, slightly constricted near base, necks bare. Flagellomeres 1 and 2 connate, except in the left antenna of a single male; circumfila sinuous in both sexes (Figs 3, 4); female flagellomeres 9–12 progressively decreasing in size (Fig. 5). Thorax (Fig. 6): Wing length: 2.0 mm in males (n = 1); 2.2–2.3 mm in females (n = 3); R_5 joining C at wing apex, R_3 and S_c absent, M_4 evanescent, Cu_A forked and Cu_{A1} joining M_4 slightly after wing midlength. Anepimeron with two irregular rows of setae. Other pleura bare. Tarsal claws bent at distal 1/3, empodia well developed, setose, not reaching the bend in claws (Fig. 7). Male abdomen (Fig. 8): Tergites and sternites with scattered scales and anterior pair of trichoid sensilla. Tergites 1–7 rectangular, with posterior row of setae, mesal setae irregularly distributed towards midlength, less numerous than those of sternites, with few lateral setae. Tergite 8 sclerotized, rectangular, with only anterior pair of trichoid sensilla. Sternites 1–7 rectangular, sclerotized, with posterior row of setae, lateral row of setae, and



Figures 2–7. Adult of *Bruggmannia chapadensis* sp. nov.: (2) male head in frontal view; (3) male flagellomere 5; (4) female flagellomere 5; (5) 9–12 female flagellomeres; (6) male forewing; (7) female foreleg claw and empodium in lateral view. Scale bars: 2, 6–7 = 0.10 mm, 3–5 = 0.01 mm.

mesal setae distributed close to the anterior margin. Sternite 8 sclerotized, rectangular, with posterior row of setae and incomplete lateral row of setae. Male terminalia (Fig. 9): gonocoxite robust, with irregularly distributed dorsal setae; gonostylus inserted at gonocoxites' midlength, short, semicircular, with strongly sclerotized marginal setae and apical row of setae; cercus with two completely separated lobes, each lobe oval, setose, with apical

setae; hypoproct shorter than cercus, setose, with rough base, almost truncated apex, with a single pair of setae; aedeagus wide, glossiform; parameres very short and setose. Female abdomen (Figs 10, 11): Tergites and sternites with scattered scales and anterior pair of trichoid sensilla. Tergites 1–7 rectangular, with posterior row of setae, mesal setae irregularly distributed, with few lateral setae. Tergite 8 sclerotized, with posterior row of setae, mesal setae

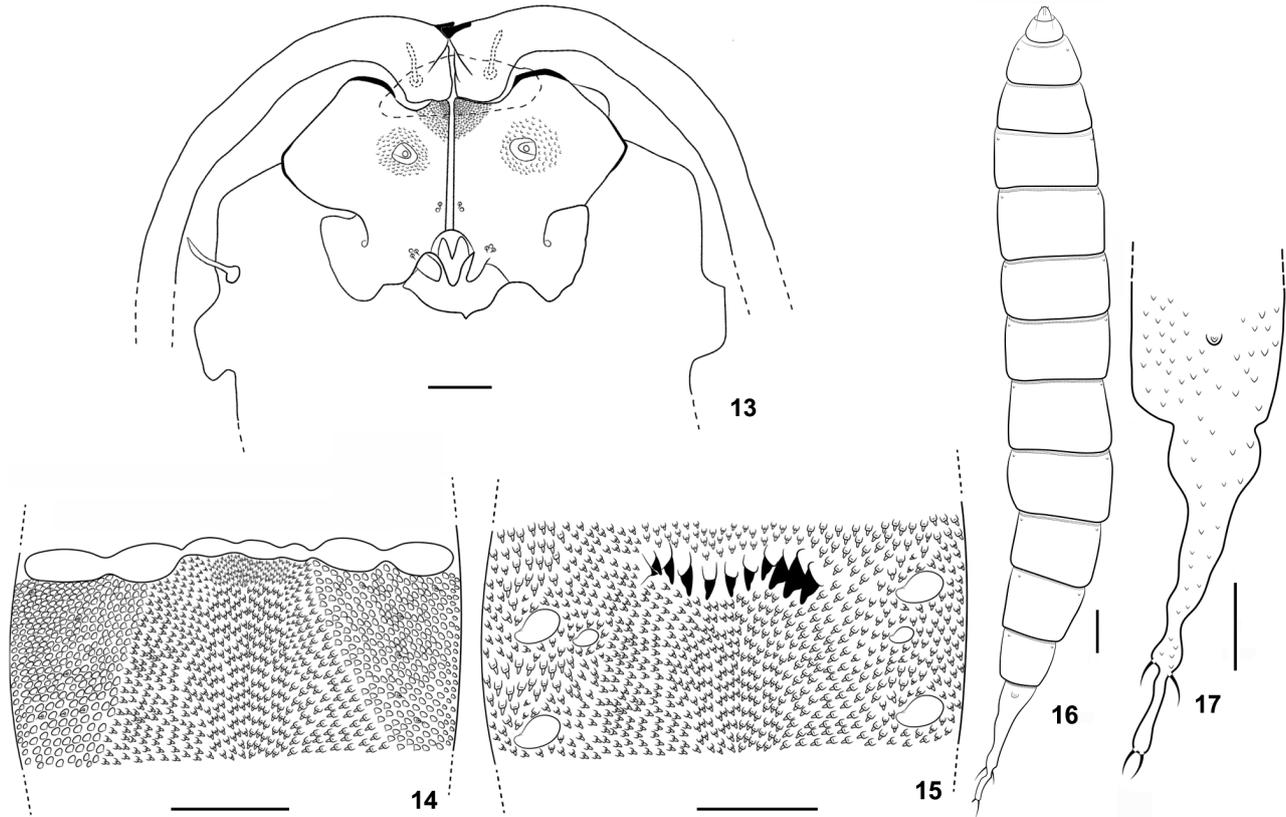


Figures 8–12. *Bruggmannia chapadensis* sp. nov.: (8) male abdominal segments 6–8 in lateral view; (9) male terminalia, dorsal view; (10) female abdominal segments 6–8 in lateral view; inside the circle a detail of the scales that cover a portion of the segment 8; (11) photograph of female abdominal segments 6–8 showing a detail of the scales on segment 8; (12) ovipositor, ventrolateral view. Scale bars: 8–10, 12 = 0.10 mm, 11 = 0.10 mm, detail = 0.02 mm.

and anterior pair of trichoid sensilla. Sternites 1–7 rectangular, with anterior pair of trichoid sensilla, posterior row of setae, lateral row of setae, and mesal setae irregularly distributed. Sternite 8 not sclerotized, covered with scales and with anterior pair of trichoid sensilla. Ovipositor (Fig. 12): protrusible, tapering to apex, striated, about 1.4 times longer than sternite 7, with two groups of long setae and some short setae ventrally near the apex; cerci tiny, separate, each one with a short apical and setose margin; hypoproct cylindrical, setulose, with two apical setae.

Pupal exuvia (Fig. 13): Body length: 3.30–3.50 mm (n = 3). Integument strongly pigmented. Cephalic region: integument ventrally rough underneath antennal sheath, and nearby the superior facial horns; dorsally rough along the frontal suture, with short spines in the midlength. Antennal bases strongly sclerotized, enlarged, conical, pointed apically at apex. Cephalic seta 0.06 mm long (n = 6). Upper and lateral cephalic margin thickened. Superior frontal horns semicircular; two pairs of lower facial papillae, one setose and other asetose; two pairs of

three lateral facial papillae: two setose and others asetose. Lower facial horns triangular. Thorax: prothoracic spiracle, short, sharp and bend, 0.08–0.10 mm long (n = 7), 0.8 times longer than the basal width of the scape. Antennal sheath ending near or at the posterior margin of abdominal segment 2, foreleg sheath reaching from the posterior margin of abdominal segment 3 to the basal 1/3 of segment 4; midleg sheath reaching the middle of abdominal segment 4; hindleg sheath ending from distal 1/3 to posterior margin of abdominal segment 4. Abdomen: Segments 2–8 with one anterior dorsal row of spines, restricted to the central portion of the segments (segments 5–8 with spines longer spines); and with short upper spines. Segments 1–7 with short spines and sculptures dorsally and ventrally; ventral surface with elliptic and smooth sculptures at the anterior portion of the segments, hexagonal sculptures laterally and short spines at the middle of the segment (Fig. 14); dorsal surface with circular smooth areas rounded by spines laterally and short spines elsewhere (Fig. 15). Terminal segment with two posterior processes,



Figures 13–17. *Bruggmannia chapadensis* sp. nov.: (13) pupa: cephalic region and prothoracic spiracle, frontal view; (14–15) pupa: abdominal segment 5: (14) ventral view, (15) dorsal view; (16) larva, general aspect, ventral view; (17) larva: terminal segment, ventral view. Scale bars: 0.10 mm.

corniform and strongly sclerotized, in females: processes shorter and more separated from each other than in males.

Larva (Figs 16, 17): Body: elongated, flattened dorsoventrally and tapered at both ends, length: 2.30–2.70 mm ($n = 2$). Color: white. Integument with horizontal striations at anterior and posterior margins of each segment. Thorax: Spatula and lateral papillae absent; one pair of setose sternal papillae; two pairs of setose dorsal papillae and one pair of setose pleural papillae. Abdomen: segments 1–7 with two pairs of setose dorsal papillae, segment 8 with one pair of setose dorsal papillae. Segments 1–8 with one pair of setose pleural papillae. Anus ventral and rounded. Terminal segment elongated, 0.30–0.35 mm long ($n = 3$), with four setose terminal papillae.

Material examined. Holotype: male, BRAZIL. Mato Grosso State: Parque Nacional da Chapada dos Guimarães, Caminho Veu da Noiva trail, 05/Sep./2011, Maia & Ascendino leg. (MNRJ). Paratypes 2 males, 10 females, 16 pupal exuviae and 2 larvae same data as the holotype, Maia & Ascendino leg. (MNRJ). Additional specimens (excluded from the type series). Rio de Janeiro, Restinga de Grumari, Brazil, Jun./2004, 9 pupal exuviae, Maia & Oliveira leg. (MNRJ).

Distribution. Currently known from Parque Nacional da Chapada dos Guimarães, Mato Grosso state (Brazil) and Restinga de Grumari, Rio de Janeiro, State of Rio de Janeiro (Brazil).

Etymology. The name *chapadensis* refers to the type-locality, Parque Nacional da Chapada dos Guimarães, where this species was collected.

Biological data. This species induces galls on leaves of *Guaipira pernambucensis* (Casar.) Lundell (Nyctaginaceae). The galls are lenticular, light green, glabrous, and one-chambered (Fig. 16).

DISCUSSION

The new species shares with other *Bruggmannia* adults the following characters: three-segmented palpus, male flagellomeres cylindrical and constricted near the base, their circumfila more projected from the flagellomeres than in the other Schizomyiina genera, ovipositor with long dorsal setae and short, separated cerci; and larvae without spatula (Gagné 1994). The new species has circumfila, claws, empodia and ovipositor that are morphologically similar to *B. elongata* Maia & Couri, 1993. However, these two species differ in the morphology of the male, especially the

shape of the aedeagus (triangular in *B. elongata* and glossiform in the new species) and in the size of the cerci, which is longer in the new species. Both species have two pairs of facial horns, but in *B. elongata* they are triangular, whereas in the new species the upper is semicircular whereas the lower is triangular.

Oliveira and Maia (2005) recorded a similar gall morphotype on *Guapira pernambucensis* in the Restinga de Grumari, Rio de Janeiro (Brazil), from which they obtained pupal exuviae which conform to that of the new species. This is the first record of *Bruggmannia* from the State of Mato Grosso.

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Author Contributions: BP mounted the specimens on microscope slides, wrote the paper and made the drawings; VCM also collected and reared the specimens, photographed the gall and wrote the paper.

Competing Interests: The authors have declared that no competing interests exist.